Numerals.

1. *Na, ra,*	4. *Go'.*	7. *Yo-to',*	10. *Reng-ta,*
2. *Yo, ho,*	5. *Kung-tto.*	8. *Hyang-to',*	11. *Reng-ta nora,*
3. *Hyang,*	6. *Ra-to',*	9. *Go'-to',*	&c. &c.

1. Oraciones y Doctrina Cristiana en Lengua Otomi—Mexico. 15—
2. Catecismo y Declaracion de la doctrina Cristiana en Lengua Otomi, computeso por el R. P. Fr. Joaquin López Yepes, Predicador Apostolico, &c. Megico. 1826.

IX.—*Illustrations of the Botany and other branches of the Natural History of the Himalayan Mountains, and of the Flora of Cashmere.* By J. Forbes Royle, Esq., F.L.S., G.S., &c. London. 1834-5.

THIS work is at present publishing in parts, of which seven have already appeared. It consists first, of an introduction, in which general views are given of the physical geography of the whole of India; and next of a principal text, in which minute details are added of the natural history of the southern face of the great Himalayan range, and immediately adjoining plains. The work is chiefly addressed to the scientific naturalist, but contains much that is also interesting to the more general student. We are not without hopes that, at some future time, the learned author will either furnish us himself with an abstract of what may be considered most exclusively geographical of the information which he has collected—or permit us to draw on his materials at sufficient length really to convey an idea of their extent and importance. In the meantime we shall attempt little more than to notice their general scope.

India, according to its natural boundaries, stretches from 35° to 22°, with its peninsula extending to 8° of north latitude; and from 67° to 95° of east longitude. Its extreme length and breadth are nearly equal, viz., about 2000 miles: but its figure is so irregular that its superficial area is not estimated higher than 1,280,000 English miles. It is bounded on the S.W. by the Indus, and on the N.E. by the Himalayan mountains, being washed on the two remaining principal sides by the Indian ocean. From its southern portions approaching so near to the equator, and its northern being nearly in the latitude of the south of Europe, great diversity may be expected both in the temperature of its climate and the character of its productions; and this diversity is further increased by the varying elevation of its surface in different places.

The Himalayan mountains rise to a prodigious height in its immediate vicinity, and three other systems of mountains traverse it in different directions, viz. the western and eastern

Ghauts, which run parallel to the Malabar and Coromandel coast, and the Vindhya range, which runs east and west across the central part of India. The first of these is at once the loftiest, the most continuous, and rises the most abruptly from the sea. Towards its northern extremity, it rarely exceeds 3000 feet in elevation; but as it approaches its junction with the Coromandel range, and forms with that the elevated tract called the Neilgherries, it is said to attain to the height of 8000 feet, thence descending as it approaches Cape Comorin. The Coromandel range no where exceeds 3000 feet, and is perforated by many considerable rivers, which, rising on the eastern slope of the western Ghauts, flow, with scarcely any exception, to the eastward. The valley supported between the two ranges like them is of varied elevation, but also ascends from north to south. In Aurungabad and the Dukhun it does not surpass 1400 feet; among the Neilgherries it reaches 7000, and the diversity of its productions is thus in the double ratio of the difference of latitude which it covers and of elevation which it attains.

It is not easy to define the exact extent of the Vindhya, or great central zone of Indian mountains. To the eastward it is found to deflect the united stream of the Ganges and Jumna, after their junction at Allahabad, and to the westward it is lost in the mountains of Guzerat. It thus constitutes a base to the triangle, of which the eastern and western Ghauts form the other two sides, and completes the boundary of what is called the table-land of the peninsula. Its height is not supposed anywhere to exceed 3000 feet, and it gradually declines both to the north and east from about 28° north latitude and 82° east longitude, where are its highest points. To the south and west it throws off many spurs, which become intermingled with the northern prolongations of the Malabar Ghauts, and many rich and diversified valleys are found interposed between.

North and west of the Vindhya range, the country descends into the valley of the Indus, of which the soil is generally sandy and covered with a saline efflorescence, and the water is brackish, and so far below the surface that the wells are from one to three hundred feet deep; while to the N.E. the alluvial plains of the great Ganggetic valley are spread along the foot of the Himalayas, and with the gigantic system of mountains to which they are attached constitute the chief objects of Mr. Royle's research.

Their ascent from the sea, in the bay of Bengal, is so gradual and uniform that Saharunpore, nearly at the foot of the Himalayas, where the East India Company has a botanical garden, long under his superintendence, is only 1100 feet above the level of Calcutta: and a line drawn between them, through Delhi and Benares, with the ascertained elevation given to it proper to both

these places (viz. 800 and 328 feet) would be nearly quite straight. The range of temperature at Saharunpore (lat. 30° N.) is from the freezing point in January to 105° in June, when the commencement of the rainy season prevents any increase of heat. This range admits of the cultivation of rice, millet, *Sorghum vulgare,* and tropical grains, as well as of the springing up of many annuals which require heat and moisture; but the extremes of temperature being far removed from each other in point of time, and the rise and fall being very gradual, a moderate climate is also obtained, from November to the end of March, which allows of the cultivation of wheat, barley, and other European grains, and the existence of species allied to, or identical with those of more temperate regions of the globe. And this double vegetation is a characteristic of an extensive tract of country in this direction. The fruit-trees of temperate climates, as the vine, orange, apple, pear, peach, &c., are thus, in particular, found to thrive well in districts of the great plain of India, in which they are in close juxta-position with plants of very different character, and requiring generally a very different soil and climate.

In approaching the base of the Himalayas a close jungle is everywhere met with, and this produces the opposite effect, for by causing shade, moisture, and a less free radiation, it carries tropical plants into a temperature much colder than they would bear under ordinary circumstances. As the jungle becomes short and scrubby, in ascending the mountains, this effect ceases, but not before it produces the apparently anomalous circumstance of an equally tropical vegetation being found, at Deyra, at the elevation of 2000 feet, as at Saharunpore in a somewhat lower latitude, and almost 1000 feet less elevation. The palms are thus here brought in close contact with many of the hardiest *coniferæ*.

After penetrating through the jungle, which with more or less denseness rises to 5000 feet, tropical shrubs entirely disappear; and from the extreme rapidity of the ascent the zones of different characters of vegetation become both more narrow and less specifically defined. Mr. Royle, however, reduces them first, generally, under two heads, viz., from 5000 to 9000 feet of elevation, and from the latter number to the highest limit of vegetation; and then enters into details regarding each, of extreme interest, but scarcely admitting of the necessary abridgment to suit our present purpose. We shall endeavour merely to seize some of the more prominent points.

The height of 5000 feet is chosen to mark the lower limit of the first division, because some few tropical perennials reach it, and snow seldom falls much below it; while the upper limit of 9000 feet is in like manner selected, because to that height the

snow always gives way before the rains set in, under the high temperature which characterizes the summer season in this latitude. Between the two, some few tropical herbaceous plants are still found, but the arboreous vegetation is exclusively that of temperate regions. Mr. Royle is minute in his details on both heads. He further points out the analogies between the Flora of this district and those of China, Japan, North and South America, the Cape of Good Hope, and some of the Atlantic islands. The double cultivation of tropical and hardy grains, as rice and wheat, already noticed as characterizing the plains at the foot of the Himalayas, is also found here, but rather on adjoining hills and valleys than on the same spots, though instances of this last also occur, arising in part from facilities for irrigation. The grasses are very rich and succulent within this district; wheat everywhere ripens well in it; the peach, apricot and vine thrive in it; the mustard tribe is extensively cultivated as yielding oil-seeds; and the potatoe, which has been recently introduced, is found to give heavy returns. In some districts, where fodder is scarce, cattle are fed on the leaves of certain trees, as *Grewia*, *Ulmus*, *Quercus*, and even some of the *Coniferæ*, these being stacked for the purpose. Mr. Royle also gives details regarding the zoology of this district, which partakes of the mixed character of its vegetation. Of monkeys the *Entellus* ascends to 9000 feet. The tiger, leopard, and others of the feline tribe, follow their prey to nearly the same height. The wild dog and hog abound. The *Cervus Jurao*, or great stag, is common, as also the *Cervus Rutwa*, or barking deer. Antelopes properly belong to the higher region, but are found to stray also into this. The eagle and vulture are common; pheasants abundant; crows and jays frequent; cuckoos most common. Among insects, the glow-worm and butterflies closely resemble those of colder climates.

The peculiarities of the lofty regions, on the other hand, closely and exclusively resemble those of high latitudes. The snow lying long, the increase of temperature, when it disappears, is very rapid, and the growth of plants is proportionate. Perennial roots are protected, while annuals and the herbaceous parts of perennials are destroyed. The character of the vegetation rapidly changes in ascending. The more delicate plants disappear, and the vegetation becomes exclusively Alpine. Cultivation ascends, on the south side, only as high as from 9000 to 10,000 feet: but on the north it is found as high as 12,000, though in both cases the crops are frequently cut green. Magnificent trees are found above this range; and far above them again a close sward of highly succulent pasture is everywhere met with. The prevailing woods are *Quercus*, Pines of many sorts, (especially *P. Webbiana, Deodoara, excelsa* and *Morinda,*) *Rhododendron, Taxus,*

Betula, Acer, Cerasus and *Populus.* The smaller trees are species of *Juniperus, Salix,* and *Ribes.* The grasses chiefly belong to *Agrostis, Poa, Festuca, Bromus,* and *Phleum.* Ferns are not common; but mosses and lichens abound.

The striking circumstance above adverted to, of the line of cultivation and perpetual snow rising higher on the north than on the south side of the Himalayas, is well known: as is also, we believe, the reason usually assigned for it, viz., the lofty, yet comparatively level surface of the country to the north, from which heat is powerfully radiated into the adjoining atmosphere. But Mr. Royle adds the further fact, that precisely as the burning plains of India are left behind, and the outer passes of the mountains are penetrated, does this effect become progressively apparent. Thus cultivation on the southern flanks of the Himalayas nowhere rises above 6000 feet: within the first passes it rises to 7000; within the next to 8000, and so on. In part the low level immediately over the plains of India may be attributed to a difficulty of irrigating, which is there also found; but this neither accounts for it altogether, nor can it be considered even a powerful cause.

Mr. Royle's statements regarding the Fauna of the upper region of the Himalayas are extremely few. The range of temperature within the jungle district he considers to be from 32° to 105°; and at 6500 feet elevation, it has been found to be from 27° to 80°, with a medium temperature of 55°. His meterological observations are not, however, formally given in any of the parts of his work yet published; and we shall not now carry our analysis of it further, content with having in the meantime indicated where a vast number of interesting statements regarding a most interesting portion of the globe may be found. We venture again to express a hope that at some future period, when the author shall have completed his contributions to scientific botany, he will turn his attention to physical geography also—in other words, that when he shall have passed, in his present work, from generals to particulars, for the benefit of botanists, he will reverse his course, and pass from particulars to generals, in our pages and for our benefit. The opportunities which he has enjoyed of making many minute observations almost imposes on him the obligation of generalizing from them, for no study of his details can enable another to do this as well. Nor need the task be undertaken formally. A condensed essay at his hands on the zones of climate, as indicated by vegetation, in India—and the principal circumstances, whether of latitude, elevation, aspect, neighbourhood, or the like, which modify their distribution, would be in itself a generalization, and a most important contribution to our branch of science.